Assignment

Task 03

This is the third of the three (3) Tasks of the Assignment.

*strictly follow the "***Assignment Guideline"** document prior to working on this Assignment Task.

Objectives:

1. Configure a complex network to enable communication between multiple sites.
2. Configure DNS, Web, and Email server to provide email and web facility.
3. Configure an IoT Server and control IoT devices.
4. Configure and work with FTP Servers.
5. Static NAT, PAT configurations to enable remote access to sites.
6. Validate and troubleshoot the network connectivity.

Background:

You, as a network engineer, are now required to enhance the network configured in Assignment – Task 02 with DNS/Web/Email Servers and Remote Access between multiple sites (Curtin University, Curtin Energy Research Division). Also, a set of new contracts have come up to configure some networks in Office A, Office B.

Curtin University has completely moved IT Services office inside Building 314. Some laboratories of Curtin University and Curtin Energy Research Division have got an upgrade from IPv4 to IPv6. Hence, IPv6 laboratories in both locations (Curtin Uni/Energy Division) must be able to communicate with each other through a IPv6 compatible tunnel. In addition, a Web Server, DNS Server and Email Servers must be setup for the domain "curtin.com" and "cenergy.com" respectively. Furthermore, a set of networks are required to be configured at new locations (Office A, Office B) according to some new requirements stated below. Once the configuration of all devices is complete, it is important to make sure that certain Servers are accessible remotely from remote locations.

The devices with the required connections are already in place following Assignment – Task 02. However, the network is yet to be properly configured. **You are only required to review the initial configuration of each device and configure them wherever necessary** and set the network up and running according to the requirements stated below. Since this task is to deal with the configuration of devices, **adding/removing/moving devices or arranging devices in the physical view of the network is not required.** *(please work only with the logical view of the network).*

Required Skill:

Since you have been contracted before to work on a complex network in Assignment – Task 02 as an experienced network engineer, Assignment – Task 03 requires you to work as a **senior network engineer**, and it is **absolutely necessary** to complete the required **practical sheets** (with *try-me* challenging questions), following the **relevant reference materials** on Blackboard as stated in CNCO2000 unit outline.

Important Notes:

- CLI of all communication devices are accessible directly without a laptop.
- Do not delete existing connections (wires).
- Testing the connectivity of network segments or devices will help you to validate the configuration of the network devices once they are done. You may frequently test the connectivity while you progress step by step to double check your work appropriately.
- If you are using the simple/complex PDU tool to test the connectivity, the first few attempts may fail due to ARP resolution (this is in line with the failures that one would see with the ping command. Ping command will send multiple ICMPs in which the first few may fail due to the same reason).
- A random set of successful test cases (under the scenario named "random") is already in place for you to test your work. You may add more scenarios according to the requirements stated in C7.
- Assignment – Task 03 must be completed using **Packet Tracer v7.3.1** (the latest version).
- **Strictly follow** the **"Assignment Guideline"** document prior to working on this Assignment Task.

This task consists of seven **(06) Components.** You will be guided through them to successfully configure the network according to the requirements stated above.

IMPOTANT: Before you start:

1. Copy the following device configuration from Assignment T02.pka to Assignment T03.pka
   - CUR_UNI.S1.314A
   - CUR_UNI.S1.314B
   - CUR_UNI.S1.HR
   - CUR_UNI.GW
   - CUR_ENGY.S1
   - CUR_ENGY.S1.IT
   - CUR_ENGY.S1.HR
   - CUR_ENGY.GW
   - R_ISP

2. Remove all access list configurations on CUR_UNI.GW and CUR_ENGY.GW
3. Remove all tunnel configurations on CUR_UNI.GW and CUR_ENGY.GW
4. Remove all the passwords on CUR_UNI.GW and CUR_ENGY.GW

C1: Configure IPv6 Network

Requirements:

i. PCs in Lab b314.A (Curtin University) must be able to communicate in both IPv6 and IPv4.

ii. PCs in AI Lab (Curtin Energy Research Division) must be able to communicate in both IPv6 and IPv4.

iii. PCs in both b314.A and AI Lab must be able to communicate with each other in IPv6 and IPv4. This communication must take place in a IPv6 tunnel configured between Curtin University and Curtin Energy Research Division.

You must use the following information when configuring the IPv6 Network.

1. Preliminary details:

PC	IPv4 IP	IPv4 Default Gateway	IPv6 IP	IPv6 IP (link local)	IPv6 Default Gateway (Link Local)	IPv6 Default Gateway (Global Unicast)
PC1.b314.A	192.168.10.2/24	192.168.10.1	2001:DB8:0:10::2/64	FE80::2/64	FE80::1/64	2001:DB8:0:10::1
PC2.b314.A	192.168.10.3/24	192.168.10.1	2001:DB8:0:10::3/64	FE80::3/64	FE80::1/64	2001:DB8:0:10::1
PC1.CUR_ENGY	10.0.0.2/24	10.0.0.1	2001:DB8::2/64	FE80::2/64	FE80::1/64	2001:DB8::1
PC2.CUR_ENGY	10.0.0.3/24	10.0.0.1	2001:DB8::3/64	FE80::3/64	FE80::1/64	2001:DB8::1

IPv6 Link Local and Gateway IPs must be configured manually on Routers where applicable. You must make use of the information provided on the table above during such a configuration.

IMPORTANT: Use the Link Local address when configuring the default gateway on a PC.

2. Tunnel Details

Tunnel	Tunnel IP on CUR_UNI.GW Router	Tunnel IP on CUR_ENGY.GW Router	Comment
4	2001:DB8:0:300::1/64	2001:DB8:0:300::2/64	Tunnel for IPv6 Traffic from b314.A to AI Lab
3	192.168.202.1 /24	192.168.202.2 /24	Tunnel for IPv4 Traffic from b314.A to AI Lab

(Hint: Configure static routes to send the b314.A/AI Lab traffic across the tunnel)

IMPORTANT: Make sure to use the correct tunnel number (3, 4) during configuration as indicated in the table above.

3. Validate the IPv6 connectivity with appropriate test cases.

C2: Configure DNS/Web/Email Servers

Requirements:

i. A DNS Server and a Web/Email Server must be setup in Curtin University on a new VLAN.

ii. A DNS Server and an Email Server must be setup in Curtin Energy Research Division.

iii. These servers must be accessible locally. (Public access will be configured later)

a. PCs belong to IT department must be configured to access the web/email servers locally via the DNS name resolution.

1. Preliminary details

Service	Server Name	IP	VLAN ID	VLAN Name
DNS	CUR_DNS	192.168.150.254 /24	150	CUR.SERVERS
HTTP and Email	CUR_WEB.EMAIL	192.168.150.253 /24	150	CUR.SERVERS
DNS	CENERGY_DNS	10.0.1.254 /24	-	-
Email **only!**	CENERGY_EMAIL	10.0.1.253 /24	-	-

Default gateway must be configured on the servers shown in the table above, accordingly.

2. DNS Entries for CUR_DNS

Record Type	Name	Value
A	curtin.com	*<find out>*
A	mail.curtin.com	*<find out>*
SOA	curtin.com	ServerName: dns.curtin.com | MailBox: mail.curtin.com | Expiry: 45 | Refresh: 30 | Retry: 10 | MinTTL: 15
A	dns.curtin.com	*<find out>*

3. Following the table above, add DNS Entries to CENERGY_DNS, accordingly.

4. Configuration of PCs to find the local DNS Server

PC	DNS Server
PC1.b314.IT	*<set to curtin dns server>*
PC1.b401.IT	*<set to curtin dns server>*
CUR_WEB.EMAIL	*<set to curtin dns server>*
PC1.b602.IT	*<set to curtin_energy dns server>*
PC2.b602.IT	*<set to curtin_energy dns server>*
CENERGY_EMAIL	*<set to curtin_energy dns server>*

Note: In here, PCs that belong to IT departments and EMAIL servers are configured to find the DNS Server.

5. Details for Email Servers

Server Name	Email Configuration

CUR_WEB.EMAIL	Domain Name: curtin.com Account (Your Name: Bob, username: bob, password: bob123)
CENERGY_EMAIL	Domain Name: cenergy.com Account (Your Name: Alice, username: alice, password: alice123)
CENERGY_EMAIL	Domain Name: cenergy.com Account (Your Name: Tess, username: tess, password: tess123)

6. Configure an email client for bob@curtin.com mail account on PC1.b314.IT, alice@cenergy.com mail account on PC1.b602.IT accordingly, and tess@cenergy.com mail account on PC2.b602.IT accordingly.
   Do not configure IP address for incoming and outgoing mail servers. Use the relevant mail domain name instead.

7. Validate the local accessibility of Servers according to the table below:

PC	Test Case	Comments
PC1.b314.IT, PC1.b401.IT	Open the web browser, goto curtin.com	Must be successful
PC1.b314.IT	Open the mail client, send an email to bob@curtin.com (itself)	Must be successful
PC1.b602.IT	Open the web browser, goto cenergy.com	**Fail** Curtin Energy Research Division must not have a web server.
PC1.b602.IT	Open the mail client, send an email to alice@cenergy.com (itself). Check whether the mail is received.	Must be successful
PC2.b602.IT	Open the mail client, send an email to alice@cenergy.com. Check whether the mail is received.	Must be successful

C3: Configure Office Networks

Requirements:

i. Office A Network must be divided into two subnets.
   a. Server_A must stay in the 1st subnet.
   b. Other devices must stay in the 2nd subnet.

ii. Office A, B must have devices configured according to the table below.

iii. IoT Server must be setup to control IoT devices such as the LAMP.

1. Office A Network Details
   a. 192.168.1.0 /24 network address must be divided into two subnets to support the following number of devices **only**.

   Subnet 1: 1 device (2 IPs - one IP for the device, the other for the default gateway)

   Subnet 2: 5 devices (6 IPs – 5 IPs for the devices, the other for the default gateway)

   (Hint: You will have to use VLSM for subnetting)

2. Devices on Office networks must be configured according to the following table:

Location	Device Name	IP Address	Default GW
Office A	Server_A	*Second Address of **Subnet 1** defined above*	*First Address of **Subnet 1** defined above*
Office A	IoT Server	*Second Address of **Subnet 2** defined above*	*First Address of **Subnet 2** defined above*
Office A	LAMP	*Third Address of **Subnet 2** defined above*	*First Address of **Subnet 2** defined above*
Office A	PC1_A	*Fourth Address of **Subnet 2** defined above*	*First Address of **Subnet 2** defined above*
Office B	*You	192.168.1.2/24	192.168.1.1

**You: Assume you are currently connected to Office B Network.*

3. Server_A should run FTP Service (account UN: cisco, PW: cisco123).
4. Configure the IoT Server as a Registration Server for IoT devices. (Register a new account UN: cisco, PW: cisco123)
5. Configure the LAMP to be controlled by the IoT Server.
   (Hint: Connect the LAMP to registration server by providing the login credentials of the IoT Server to the LAMP)
6. Validate the local connectivity of each office with appropriate test cases.

C4: Configure WAN Network

Requirements:

i. WAN Routers' interfaces must be configured with IPs.

ii. WAN Routers must be configured with static routes. **Do not summarize routes. When configuring static routes, DO NOT use an interface to forward the traffic, instead use the next hop IP address.**

iii. No dynamic routing protocols must be used.

iv. Gateways of Office A, B must be configured with default route to forward traffic to WAN facing interface. **Use the next hop IP to forward the default route traffic.**

1. Routers' interfaces must be configured with IPs according to the following table:

Router	Interface	Networks
R_ISP	Gig0/1	209.165.210.29 /24
WAN_R1	Fa0/0	209.165.210.30 /24
WAN_R1	Fa0/1	209.165.220.30 /24
WAN_R1	Fa1/1	209.165.230.30 /24
R_A	Gig0/1	209.165.220.29 /24
R_B	Gig0/1	209.165.230.29 /24

2. Change the subnet masks of the networks (CUR_UNI.GW – ISP network, CUR_ENGY.GW – ISP network) to 255.255.255.0

3. Static routes on the routers listed below must be configured for the networks indicated:

Router	Networks
R_ISP	209.165.220.28 /24 209.165.230.28 /24
WAN_R1	209.165.100.28 /24 209.165.200.28 /24
R_A	default route, next hop IP *<find out>*
R_B	default route, next hop IP *<find out>*

4. **IMPORTANT: You must resolve the following error/warning if shown during the static route configuration.**

   "%Inconsistent address and mask"

5. Validate the connectivity of WAN network with appropriate test cases.

C5: Configure NAT (Network Address Translation) for Public Access

Requirements:

i. Static NAT, PAT, NAT overloaded translation must be configured on routers to facilitate public access to devices in local networks.

ii. Server_A must be allowed for FTP traffic from external networks (via PAT).

iii. IoT Server must be allowed to be accessed by external networks (via PAT).

iv. CUR_DNS, CUR_WEB.EMAIL, CENERGY_DNS, CENERY_EMAIL must be allowed to be accessed by external networks (via static NAT).

1. Configure **static NAT** on relevant routers according to the following table:

Device	Public IP
CUR_DNS	209.165.100.32 /24
CUR_WEB.EMAIL	209.165.100.31 /24
CENERGY_DNS	209.165.200.32 /24
CENERGY_EMAIL	209.165.200.31 /24
You	209.165.230.29 /24

2. Configure **PAT** on relevant routers according to the following table:

Device	Public IP	PAT for Traffic Type
Server_A	209.165.220.29 /24	FTP
IoT Server	209.165.220.29 /24	HTTP

(Hint: Figure out the port number to perform PAT by looking at the traffic type column)

3. Configure **NAT overloaded** translation on Gig0/1 interface of the Router (R_A) for the outgoing traffic of the local network 192.168.1.0 /24.
   a. Define an access list (id =10) to permit translation for the local addresses in 192.168.1.0 /24 network
   b. Perform NAT overloaded translation on Gig0/1 interface of the Router (R_A).

4. The step above will let new devices connected to the local network of Office A be translated (with random port number) when communicating with external devices.
   a. You may test this by adding a new PC to Subnet 2 and ping any external public address. Switch to simulation mode and observe how the source IP of the packet is translated when it leaves the local network. You can also use "show ip nat translation" command to view the NAT table.

5. Configure **NAT overloaded** translation on Se0/0/0 interface of CUR_ENGY.GW for the outgoing traffic of local network 10.0.1.0 /24.
   a. Define an access list (id =10) to permit translation for the local addresses in 10.0.1.0 /24 network
   b. Perform NAT overloaded translation on Se0/0/0 interface of CUR_ENGY.GW.

6. The step above will let devices in 10.0.1.0 /24 network be translated (with random port number) when communicating with external devices.
    a. You may test this by going to the browser in PC1.b602.IT type “209.165.100.31” (Curtin’s Web Server).
    b. The home page of Curtin Webserver will be shown on PC1.b602.IT, if successful.
7. Furthermore, validate the public access with appropriate test cases.

C6: Validate Network Connectivity

Requirements:

i. Create following **scenarios** in Packet Tracer and use **complex PDUs** test connectivity.

ii. **You must submit Packet Tracer scenarios with relevant complex PDU test cases in your .pka file** according to the following table. Hence it will be assessed during marking.

Scenario Name	Source	Destination	Connectivity	Comment
IPv6_4	PC1.b314.A	2001:DB8:0:10::3 (PC2.b314.A)	Successful	IPv6 Connectivity
IPv6_4	PC1.CUR_ENGY	2001:DB8::3 (PC2.CUR_ENGY)	Successful	IPv6 Connectivity
IPv6_4	PC1.b314.A	192.168.20.2 (PC1.b314.B)	Successful	IPv4 Connectivity
IPv6_4	PC1.CUR_ENGY	10.0.1.2 (PC1.b602.IT)	Successful	IPv4 Connectivity
IPv6_4	PC1.b314.A	2001:DB8::2 (PC1.CUR_ENGY)	Successful	Tunnel Test (IPv6)
IPv6_4	PC1.b314.A	10.0.0.2 (PC1.CUR_ENGY)	Successful	Tunnel Test (IPv4)
Office	You	FTP Server_A (UN: cisco, PW: cisco123)	Successful	
Office	You	IoT Server (UN: cisco, PW: cisco123)	Successful	Turn ON/OFF the LAMP, once logged into the IoT Registration Server
Curtin Servers	You/ PC1_A/ PC1.b602.IT	**Web Server at Curtin University (via Public IP)** Open the browser and type the public address of Web Server of Curtin University to access the Web	Successful	
Curtin Servers	PC1.CUR_ENGY	Ping Web Server at Curtin University (via Public IP)	Successful	via Public IP
Curtin Servers	PC1.CUR_ENGY	**Web Server at Curtin University (via Public IP)** Open the browser and type the public address of Web Server of Curtin University to access the Web	**Fail**	Why PC1.CUR_ENGY can ping the web server of Curtin University, but fail to access it via the web browser ?
Curtin Servers	You	Ping DNS Server at Curtin University (via Public IP)	Successful	
Curtin Servers	You	Ping Email Server at Curtin Energy Research Division (via Public IP)	Successful	
Curtin Servers	You	Ping DNS Server at Curtin Energy Research Division (via Public IP)	Successful	
Curtin Servers	PC1.b602.IT	**Web Server at Curtin University (via the domain curtin.com)** Open the browser and type "curtin.com" to access the Web	**Fail**	PC1.b602.IT, the CENERGY_DNS was not configured to resolve the name curtin.com
Curtin Servers	You/ PC1_A	**Web Server at Curtin University (via the domain curtin.com)** Open the browser and type "curtin.com" to access the Web	**Fail**	DNS Servers are not configured on PCs yet. Fix the DNS Servers on the PCs to Successfully PASS this test case
Local	PC1_A	Local Devices	Successful	LAMP must be accessed via the IoT Server

Summary:

Congratulations, you have completed the Assignment – Task 03

C1: Configure IPv6 Network

C2: Configure DNS/Web/Email Servers

C3: Configure Office Networks

C4: Configure WAN Network

C5: Configure NAT (Network Address Translation) for Public Access

C6: Validate Network Connectivity